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INTERMOUNTAIN STATION
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# FIRST ANNUAL REPORT

# PRIEST RIVER EXPERIMENT STATION

JANUARY , 1912.

SS
Priest River
Annual Report.

# ESTABLISHMENT, ORGANIZATION
# AND
# EXPERIMENTAL WORK
# OF THE
# PRIEST RIVER EXPERIMENT STATION.
# PRIEST RIVER, IDAHO.

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ANNUAL REPORT

BY

Donald R. Brewster - Forest Assistant

arrangement and
Preface by F. I. Rockwell

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January , 1912.

# ESTABLISHMENT OF PRIEST RIVER EXPERIMENT STATION.

## Prefatory Remarks.

Prior to September, 1911, the silvical work of District No. 1 was of a more or less extensive nature consisting largely, aside from the minor investigations carried on from the Supervisor's officesof gathering data for volume tables to be used in reconnaissance work, and of yield tables to enable the calculation of the value of the soil for forestry as against agricultural purposes, or for the assessment of damages to immature timber. Minor studies on natural reproduction, forest management and deterioration of fire-killed timber had been made the subject of annual silvical reports by the forest assistants on the several Forests. The results of such investigations are given in the general silvical reports for the district for the years 1910, 1911 and 1912.

In nursery practice little experimentation was carried on, cut and driedmethods being used on a considerable scale and changes in method being made or experiments being undertaken only when large losses made them imperative. Field planting was recognized as being more or less in an experimental stage and numerous experiments were carried on on various Forests to determine the best methods for planting but these were so scattered and in many cases on so large a scale in the attempt to make the plantations of some commercial importance, that the cost of the experiments were very high while the percentage of successful plantations was extremely low. As a consequence while the investigative and

planting work of the District yielded much valuable information, it was to a certain extent disappointing, in that the results were not commensurate with the amount of time and money spent. This was due in a large measure to the extensive nature of the work, whereby our energy and means was being scattered over many projects and a large territory, instead of being concentrated in a limited space and in small experiments where greater economy could be practiced. These are the conditions which led to the establishment of a forest experiment station where the experimental investigations covering a large number of different lines of work could be concentrated. Such concentration works not only toward greater economy because of the saving of time, energy and duplication of work, but the men at the experiment station who are engaged on scientific investigations continually, instead of more or less spasmodically as must be the case with the forest assistants on the National Forests, become highly skilled in the work, and because of this increased efficiency are able to produce much more valuable results than can be obtained by men working under less intensive methods.

Having decided upon the desirability of establishing an experiment station, it became necessary to choose a suitable site. According to a forest map of North America pre-

pared by the Dendrologist, there are three distinct forest regions represented in the area embraced in District No. I. The "Northern Forest" of the Appalachian Mountains, Great Lake Basin, and Canada is represented by the four National Forests of Michigan and Minnesota. That portion of Montana east of the Continental Divide, the Dakotas, and the Southern and eastern portions of the Missoula, Bitterroot and Nez Perce Forests, comprise an important part of the "Rocky Mountain Forest," whose important commercial species are limited to the lodgepole and western yellow pines, Engelmann spruce, and Douglas fir. The remaining National Forests of western Montana and Northern Idaho with their dense heavy stands of western white pine, western larch, Douglas fir, lowland fir, hemlock, and cedar are essentially a part of the "Pacific Coast Forest," Some of them contain however, a more or less irregular and wide band of transition forest where the latter region meets the Rocky Mountain Forest. Eventually it may be desirable to establish an experiment station within each of these three regions. For the present however, because of shortage of men and funds, it was thought best to concentrate our energies and resources at one station, that of course to be located in the region in which the need is most pressing, where the problems to be solved are most important.

Only a comparatively small portion of District No. I, about 1,370,000 acres, is embraced in the region known as the

Northern Forest. While the silvical problems yet to be solved are both pressing and important, yet most of the older forest schools on the continent, some of whom have established small experiment stations, are located on or adjacent to this territory, and are continually carrying on forest investigations the results of which will be available for the use of the Forest Service. The State of Minnesota particularly through its Department of Forestry at the State University, has established a forest experiment station at Cloquet, Minnesota, which will deal with problems very similar to those found in the National Forests of that region. Therefore in the selection of a site for the experiment station this region was passed over.

A large part of the National Forest area in the District about 1,4,000,000 acres, is within the Rocky Mountain Region, and the problems to be solved here are numerous and important. However this region is well represented by three forest experiment stations established by the Forest Service in Districts 2 and 3, and the results of the experiments performed there are probably quite applicable to the same types in District I. Therefore an experiment station in this region is not particularly urgent at the present time.

In the Pacific Coast Forest region however, no Forest experiment station has yet been located. The area of this region within the District is about the same as that of the Rocky Mountain Region, 14,000,000 acres. From a com-

mercial point of view, however, it is much the most important since it contains nearly 80 per cent of all the merchantable sawtimber within the District, while at the present time it is yielding approximately 70 per cent of the total cut. In it is found a larger number of coniferous species and important forest types than in the other regions, and the systems of management which must be followed are correspondingly more complex and involved. Moreover the portion of the region within this District is peculiar in that it embraces the largest area on the Continent on which the predominating species is western white pine, commercially the most valuable of the western species; therefore even though an experiment station may later be established in District 6, its field of investigation would be decidedly different. All these reasons considered, there was no doubt of the advisability of placing the station in the Pacific Coast region and in the Western white pine belt.

There was more difficulty in deciding on the Forest. The important essentials in determining the proper locations were: (1) Representation of the forest types of the region in relative order of importance. (2) Cleared areas suitable for reforestation experiments in the more important types. (3) Reasonable accessibility to the District Office and to transcontinental routes, of travel. (4) Land wholly National Forest land and subject to withdrawal for exclusive use

of experiment station.

(5) Suitable building site, including a good water supply, desirable surroundings, and as many other natural conveniences as possible.

Practically all of the available sites within reach of the main railway lines on the most promising Forests, viz. the Kootenai, Kaniksu, Coeur d'Alene, St. Joe and Lolo, were examined or considered, and the vicinity of the Benton Ranger Station on the Kaniksu, National Forest, was finally chosen as coming the nearest to fulfilling the desired conditions. Each of the important forest types of the region - western white pine, western larch, Douglas fir, and western yellow pine, are found on the 720 acres withdrawn for the use of the Experiment Station, and in about the same relative importance as they exist in the region. In addition large flats covered with lodgepole pine in pure stand are only one and one-half miles distance, while a trail from the station along a ridge top leads up into the Alpine type on the top of Bald Mountain.

In the western white pine type about 150 acres formerly covered with mature western white pine, western larch, and western red cedar timber was cutover in 1910 and 1911 or will be cut during the present year, and offers excellent opportunities for experimentation in securing reproduction of the desirable species both by natural and artificial regeneration, and also for experiments in the introduction

of exotic species. In the western yellow pine and western larch types, areas of considerable size have been bared by recurrent fires, thus providing sufficient ground for experimentation in these types and for the establishment of experimental nurseries. Thrifty even-aged stands of western white pine, western larch, Douglas fir, and western yellow pine of 40 to 50 years of age occupy a large part of Benton Creek Basin, in which the Experiment Station is situated, and will afford unrivaled opportunities for experiments in thinnings, and for the establishment of permanent sample plots for the study of yield and growth. All in all I believe the site selected is as nearly ideal as could be found.

H. I. Rockwell

Forest Assistant.

March 1, 1912.

PLATE I.
(D1-21)

The western white pine type at the Priest River Experiment Station. An over-mature stand 225 years old in Benton Creek Bottom, consisting of western white pine, western larch, western red cedar, and hemlock.

PLATE II

Experimental planting area for the western white pine type at Priest River Experiment Station. Area logged in 1910 by Jurgens Bros. and brush burned broadcast; the large amount of debris left on ground after logging typical of over-mature stands in this type.

PLATE III
(D1-17)

The western larch type at the Priest River Experiment Station; a 50 year old even-aged stand on Benton Flat. Opening thru center is the trail from Benton Ranger Station to the Experiment Station.

PLATE IV

The western yellow pine type at the Priest River Experiment Station, typical of the south slopes at 2500 feet elevation on the Kaniksu National Forest. Note patchy growth in even-aged groups. To the right in background is shown the heavily timbered northerly slopes and bottom of Benton Creek, typical of the western white pine type. The Experiment Station is located in valley below, slightly to the right.

PRIEST RIVER EXPERIMENT STATION.

ANNUAL REPORT.

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January -- 1912.

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## I. Organization:

### A. Establishment:

In August, 1911, after it was decided to establish a Forest Experiment Station in District I, a party, consisting of Raphael Zon of the Washington Office, and R. Y. Stuart and F. I. Rockwell of the District Office, visited several promising sites on the Northwestern Forests of the District. After considering all points, the final location was chosen at the Benton Ranger Station on the Kaniksu Forest, in the Priest River Valley.

This site offered the greatest diversity of forest types within the smallest radius and was in the region of maximum development of Western White Pine and Western Larch, the two species which it was particularly desired to study. The immediately surrounding country furnished an exceptional opportunity to observe these species in every aspect and silvicultural phase, from sales, old cuttings, burns, and stands of every age, mixture, and site quality.

The location was excellent for the study of climatology and the ecology of forest types, one of the most important series of experiments to be undertaken. Within a half-mile of

each other were found available sites illustrating the entire range of conditions in the region, from the moist NE slope to the dry southwest slope, with an intermediate type between.

There was a good building site close to a meadow of 15 acres with a small stream of pure water running through it. This site was only one-quarter mile from the stage road, and situated midway between the proposed weather stations. The principal drawback, the comparative isolation of being 15 miles from a railroad and with mail only twice a week in the winter and three times a week in the summer-- was not thought of sufficient importance to counter-balance the superiority of the location in other respects. A railroad is already surveyed up the valley, with a townsite ten miles from the Station and it is sure to be built in a few years.

The valley contains a number of presperous ranchers, several of them within a short distance of the Station, making it possible to obtain fresh milk, butter, eggs and vegetables, as well as meat and poultry. These ranchers provide a ready source of good temporary labor for extra work at busy seasons.

The fuel supply is excellent and cheap, there being hundreds of standing fire-killed larch trees within easy skidding distance of the buildings. This winter's supply of wood, consisting of 100 16-foot logs, 1 to 3 feet in diameter, was felled and skidded and decked for sawing by two men and one horse in less than a week. The Station is connected with the Kaniksu telephone line which makes it possible to reach Priest

River or Coolin quickly for supplies, telegrams, etc. On the other hand, there is a considerable additional expense for freight on heavy equipment, lumber and building material, but the advantages are thought to outweigh this factor.

About September 1 Messrs. Zon and Rockwell and Forest Assistants W. W. Morris and D. R. Brewster, on temporary assignment from the Coeur d'Alene and St. Joe Forests respectively, assembled and started preliminary work. A camp of about ten men was organized, with a cook, and the work of clearing and improvement put under way. By the middle of October the most urgent part of the work was finished, the laboratory half completed, and things were in such shape that the crew could be disbanded and the balance of the fall work left to be completed by Forest Assistant Brewster and one other man. The former cook, Doublas MacDonald, was kept as the assistant and appointed Forest Guard November 16. The laboratory and a cabin for MacDonald and his family were finished by the carpenters by the end of October and since then experimental and routine work has occupied the entire time of the Station force. MacDonald, altho without much education or training, has been quite satisfactory. He shows much interest in the work, is quick to learn, and has a strong sense of responsibility.

B. Improvements.

A brief description of the improvements completed and planned follows:

1. Clearing:

This work was done mostly in a thick stand of White Pine, Cedar, Larch, Douglas Fir, Yellow Pine, white Fir and Hemlock, 50 years old, reproduction on an old burn. One and one-quarter miles of trail 8 feet wide werebuilt connecting the weather stations with the Laboratory. One third mile of road was built 12 feet wide connection the buildings with the Ranger Station and stage road. A temporary foot path was out along the north side of the Creek to the stage road, making a more direct route to the experimental area known as Block C. One acre was cleared at the meteorological station on the Northeast slope. Two acres were cleared for experimental plots in Block A and one-quarter acre was cleared and plowed in Block A for nursery and transplant beds. This clearing in Block A was done in a comparatively open glade covered with brush and scattered reproduction. One acre was cleared of logs on a burned over slashing, Block C. One acre was cleared at the building site.

2. Water Supply Work.

After running a line of levels with a transit, it was found feasible to put in a gravity water system by running a pipe line about 3200 feet up Benton Creek,- the small stream which runs through the meadow near the buildings. A ditch line running almost due east along the creek bottom was surveyed and cleared of brush, giving an almost continuous grade and a prac-

tically straight line. A difference in elevation of 40 feet was thus secured between the level of the highest building and the inlet. With two-inch wooden pine, this will deliver 13 gallons per minute at good pressure. A ditch for the pipe, from ten to twelve inches deep, was dug, and a dam 3 feet high was built at the inlet to provide a settling basin and entrance head for the water.

The pipe and fittings of this line were ordered as soon as we had sufficient information as to size, etc., but the length of time consumed in coming by freight from Seattle and in being hauled up from the railroad prevented its being laid before the ground froze along the ditch. It will be completed early in the spring.

3. Buildings.

(a) A laboratory and office building 24' x 26' story and a half high, contining five rooms, was erected in October. The plans were prepared, bids sent out, and the lumber hauled from Priest River, in September. No painting was done and one of the upstairs bedrooms was left unfinished, as it is needed at present for a store room. It is a solid, well-built structure set on larch blocks. The foundation is boarded and banked for warmth; outside walls built of shiplap, paper and drop siding; inside walls finished with cedar shiplap; matched white pine floors; and cedar shingle roof. The ground floor contains a large laboratory and office room, 15 x 23, containing seven windows and giving

room for office tables, work benches, filing cases, and herbarium and specimen cabinets. An instrument room and a kitchen, each 9½ x 9½, complete the floor. During the present winter this building is being used temporarily by the man in charge for a residence.

(b) A one room frame cabin, 12 x 20, was erected to serve as a dwelling for Forest Guard MacDonald and his family, during the present winter. The walls are of 12-inch boards battened on the outside and with paper on the inside, and it has a good shingle roof. A cellar, for storage of vegetables and provisions, 8 x 12, with an outside entrance, was dug under this cabin, before building. Later on the cabin will serve a very useful purpose as a store room and work shop, in place of the 14x14 tent in use for this at present.

(c) For keeping wood and lumber dry, two shelters 12' x 18' have been built of larch poles with strong roofs of cedar shakes. The total cost of each shelter was the labor of two men for a day and the expense for nails, a total of about $6.00 apiece.

(d) A green house, 12' x 18', has been constructed, eight feet south east of the laboratory, in a position where it will get the south and west sun. It has a 2½ foot bench on each side, running the full length of the house, and room for a third in the center when needed. This will provide sufficient room for all the flats at present nec-

Form 230

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

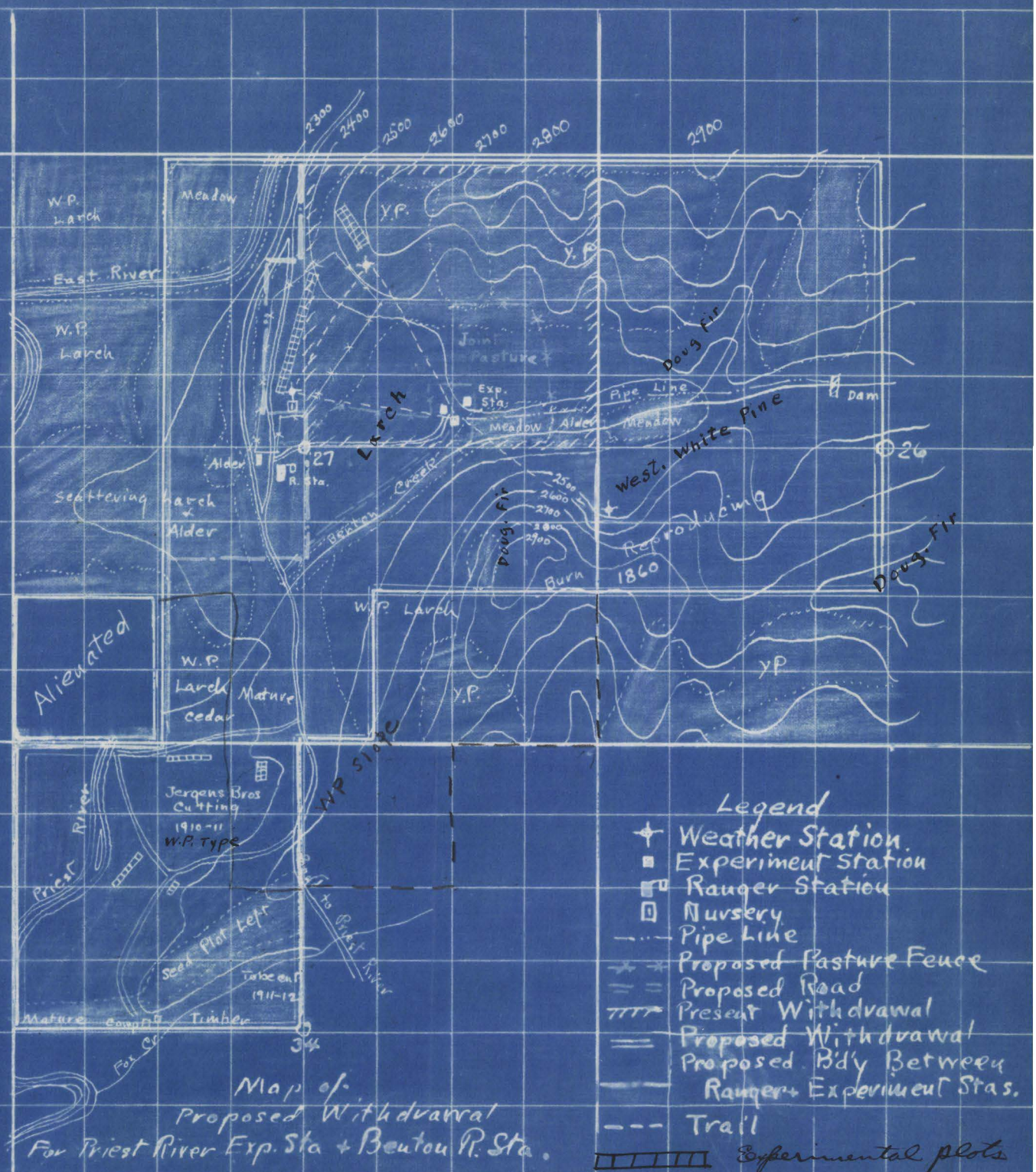
# MAP SHEET

No. _____ Kaniksu National Forest.

Division _____ District _____, Block _____

T. 58 N, R. 4 W., Boise M., Sections 26-27-34; Quarter _____

Mapped by D R Brewster 9/26/11 Scale: 4 inches = 1 mile.




Map of
Proposed Withdrawal
For Priest River Exp. Sta + Beaton R. Sta.

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PLATE V

Areas suitable for experimental investigations in western yellow pine type on south slope, at Priest River Experiment Station.

PLATE VI

Benton Meadow and Benton Creek Valley, looking up stream from Priest River Experiment Station laboratory.

PLATE VII

One of the ranches in the vicinity of the Priest River Exreriment Station, resulting from improvement of a natural meadow.

PLATE VIII

Priest Lake, Kaniksu National Forest, Idaho's most beautiful lake. The summer headquarters of the Kaniksu Forest are located here. The Experiment Station lies on stage line midway between the Station of Priest River and this popular summer resort.

PLATE IX

The beginning of the Priest River Experiment Station. Camp established to make the first improvements.

PLATE X

The first team arriving at the Experiment Station grounds and the crew which established the Station.

PLATE XI
(D1-7)

Laboratory and office building at the Priest River Experiment Station under course of construction, Kaniksu National Forest.

PLATE XII
(02271A)

Trail from Experiment Station buildings to control meteorological Station and experimental nursery.

PLATE XII-A

Clearing sample plots for experiments in the best methods of securing reproduction of western white pine;- whether by natural reproduction from adjoining seed plots, or by some method of sowing or planting. Rubbish on ground consists chiefly of rotten western hemlock or white fir or western red cedar log, heavy larch butts, and unburned tops. Amount of waste very large because of decadent condition of stand which was logged.

PLATE XIII
(D1-8)

Reservoir site and partially completed dam on Benton Creek, to provide water supply for the Priest River Experiment Station, Kaniksu National Forest.

essary for seed testing and other winter work. So far only one bench has been required for the tests and the other has served for the work of hand extraction of cones, counting seed, etc. The house is built on seasoned cedar blocks bedded on solid clay. It has hewn larch sills, and uprights and purlins of seasoned cedar, 4x4. The rafters are cypress milled specially for the purpose with a rabbet and lower groove for draining off the moisture. The walls are three feet high, made of shiplap and paper inside and out, and drop siding on the outside. Double strength glass 16 x 20 was used on roof and ends.

(e) A five room dwelling for the man in charge will be built during March and April. It is being planned to haul the lumber in February over snow roads, when it can be done most cheaply.

(f) The wire is on hand for a two-wire-and-pole fence for a forty acre horse pasture which will be built in the spring.

(g) Additional necessary clearing around the bukldings and for experimental work will be done during the early summer and the water supply will be completed as soon as possible in the spring.

4. Additional Improvements Needed.

(a) A good barn should be built during the coming summer.

(b) The meadow should be cleared and plowed and sown to hay.

(c) The green house, laboratory and dwelling should be painted and finished inside and also provided with screens.

(d) A better heating system is needed for the green house. For this winter we have been depending upon an air-tight wood heater. This works well during the day-time when it can be watched once in every four or five hours, but has proven very unsatisfactory during the low temperatures of the night when the large amount of radiating surface allows the house to cool very greatly--an unsatisfactory condition for seed tests. To partly remedy this a large canvas tent fly has been stretched over the north side and about 1/3 of the south side which allows plenty of light for the testing work but prevents radiation from two thirds of the house. With this, a much steadier heat has been secured with less fuel. It has been found that green fir mixed with the larch wood holds fire over night and with this it has been possible to keep the temperature above 40° F. on average nights. An oil heater has been tried during the night, which keeps up the temperature but burn a gallon of oil in ten hours, which to too expensive for steady use. A thermograph record has been kept since January 10 when the tests were started, and on the coldest night the record went down to 29° when it was 2° outside. Early in the month the minimum was as low as -20 twice and frequently below -10.

As a result it has been thought necessary to adopt the plan of getting up at 2 A.M and replenishing the fire during the cold weather and this will be done during the remainder of the winter, making it possible to keep the night minimum up to 50°. This will give a range of 30° during the day with the average between 60° and 70°. Even this range can not be considered ideal for a green house. The ultimate solution must be hot water heat, as being the most suitable for wood fuel. The same boiler and system could be used to heat one or both of the other buildings. This will undoubtedly mean a reduction in the amount of fuel necessary and a consequent saving in labor of sawing. Ithink it will be impracticable to run the green house all next winter by the present plan and if the seed testing and other work is to be carried on, some improvements in the heating system must be provided.

(e) The sanitary arrangements are not yet all that could be wished. A concrete septic tank as the center for aa small sewer system is thought to be the most efficient and economical method for the disposal of sewage and waste and it could be installed quite cheaply during the coming summer, in connection with the water system.

C. Equipment.

The Station is well provided with tools, tents and similar equipment. An excellent library on Forestry and related subjects has been furnished, which will be enlarged as needed. The laboratory has a five-light gasoline

lighting system which has so far proved satisfactory. A similar system will be provided for the dwelling. Window shades are needed for all the buildings, and linoleum for the floors of some of the rooms. Screens will be needed for the downstairs windows.

In the line of experimental equipment there is on hand, besides the instruments furnished by the Weather Bureau:

1 camera and tripod
2 Aneroid Barometers
3 Anemometers
1 Photometer
2 Hypsometers
1 cog Psychrometer
1 balance and set of weights to 50 grams.
40 soil cans
2 folding soil ovens.
60 Petrie dishes for seed germination.

The following additional equipment is needed, listed in order of importance:

Five soil thermometers
Five cylindrical bulb thermometers
One set soil sieves
one air thermograph
One insulated germination chamber with hot water (jacket
One seed cleaning machine
One good dissecting microscope
Several cases for herbarium specimens
One mercurial barometer
One Psychrograph

100 glass-stopper jars for seed samples and specimens
One air and soil thermograph.
Two portable sets Maximum and Minimum thermometers
50 small pots for the greenhouse.

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One seed sampling machine.
One large pendulum clock for maintaining standard time.

To be of the greatest permanent value, the work of the Station must be put on an accurate scientific basis. This work should not be crippled and limited during the first years by a lack of the necessary instruments and equipment. Labor-saving devices should be installed so that the time required for routine work and maintenance may be reduced to a minimum.

D. Costs.

1. Improvements in 1911

| | |
|---|---|
| Laboratory - - - - - - - - - - - - - - - - - - | $ 646.00 |
| Green house - - - - - - - - - - - - - - - - - | 168.37 |
| Cabin - - - - - - - - - - - - - - - - - - - - | 89.39 |
| Clearing - - - - - - - - - - - - - - - - - - | 78.65 |
| Trails - - - - - - - - - - - - - - - - - - - | 102.27 |
| Nursery - - - - - - - - - - - - - - - - - - | 74.81 |
| Road to Benton Station - - - - - - - - - - | 91.75 |
| Water Supply - - - - - - - - - - - - - - - | 548.20 |
| Electric Line for Met'l work - - - - - - - | 28.01 |
| Miscellaneous Improvements - - - - - - - - | 157.18 |
| Total | $1984.63 |

2.

Equipment Purchased - - - - - - - - - - - - - - $134.4

3. Experimental Work and Administration in 1911.

| | |
|---|---|
| Establishing Camp - - - - - - - - - - - - - - | 42.86 |
| Surveying and Mapping Admin. Site - - - - - - | 17.63 |

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| | |
|---|---|
| Preparing Experimental Areas - - - - - - - - - | $220.87 |
| Climatic Varieties- Experiments- - - - - - - | 73.01 |
| Planting and Sowing Methods - - - - - - - - - | 14.96 |
| Seed Production Study - - - - - - - - - - - - | 89.36 |
| Introduction of Exotics - - - - - - - - - - - | 9.78 |
| Met'l Observations-- - - - - - - - - - - - - | 29.17 |
| Nursery Practice- - - - - - - - - - - - - - - | 18.53 |
| Seed Extracting- - - - - - - - - - - - - - - - | 13.05 |
| Seed Testing - - - - - - - - - - - - - - - - - | 4.00 |
| Correspondence and Supervision - - - - - - - | 293.20 |
| Maintenance and Sundays - - - - - - - - - - | 125.52 |
| Total | 951.94 |
| Grand Total - | $3071.04 |

The next report will give the costs of the individual Experiments, Maintenance, Supervision, and a depreceiation charge of ten per cent on improvements will be divided pro rata among these items.

E. Recommendations.

Opportunities for investigative work are so manifold at the Station that one man can scarcely begin to do the work that should be done. The work is so important and the permanent investment is so large that precautions should be taken to prevent interruptions in continuity and the fullest advantage should be taken of the equipment of the Station. In order to do this, another technical man should be assigned to assist the man in charge. This assistant should be able

to handle the work at any time in case that the man in charge is called away or is incapacitated. He would be of immense assistance in all of the Station work.

II. EXPERIMENTAL WORK OF THE STATION

A. Experiments Started .

All experiments which have been definitely started are each treated separately in another part of the report. Nineteen esperiments are included, as follows:

a. Test of Climatic Varieties, -3

b. Planting and Sowing Methods, -5

c. Nursery Practice, -7

d. Introduction of Exotics, -2

e. Seed Production, -1

f. Meteorological Observations. -1

g. Seed Testing -1 (besides miscellaneous tests for other experiments)

In addition to the work mentioned in the separate reports on the above, further work is planned according to the following outline:

1. Nursery Practice.

a. Degree of Shading. The extent to which different species require shade during the seedling stage in the nursery beds.

b. Fall Heeling in. Work along this line has already been started with the remainder of the planting

stock used in fall Experiments and definite observations will be made on the results. Additional work along this line will be started next fall.

c. Root Pruning. Methods of producing roots of uniform length and character by pruning. This experiment will be deferred until seedling stock is available in the nursery.

d. Cultivation of Seed and Transplant beds versus watering. It is planned to study the difference in results secured by these two methods during the life of three-year-old transplants.

e. Prrparation of Seed Beds for the Purpose of checking the development of Tap Roots in favor of Lateral Roots. This will be an experiment in trying to overcome the tendency of some species of seedlings to develop long tap roots at an early age.

f. The Effect of Origin of Seed on Growth.

Seed of Different Climatic Varieties to be tested in the Nursery and the effect produced by change of Climate noted. This will be started as soon as the necessary varieties of seed are secured.

2. Seed Production Study.

Further Experiments will be carried on in the summer and fall with white pine and with other species to determine as many different facts as possible relating to the production of seed.

3. Meteorological Observations.

It is planned to put in a weir in Benton Creek for the study of run-off in connection with observations of precipitation.

4. Seed Extraction.

Experiments in extracting small quantities of cones of various species will be carried on this winter and next fall. It is planned to build a small portable kiln which will hold about one bushel of cones. The kiln proper will be one box inside of another made of wood or sheet metal and insulated with some non-conducting material. Below this a detachable stove chamber for one or two small oil heaters will be placed so as to secure a good circulation and even heating at any desired temperature and for any length of time. Experiments with Douglas Fir, Western Larch and Western Red Cedar will be conducted this winter. In this connection some kind of seed cleaning mill with fanning attachment will be needed.

5. Seed Testing.

The fertility of all seed used in experiments and sent in from Forests and other sources will be tested in the greenhouse. These tests will be made in three ways:

1. By cutting test of 200 seeds.

2. By a soil test of three months, using 200 seeds

in a flat of sterilized sand, subjected to greenhouse temperature of about 65° F.

3. By a chamber test of 200 to 500 seeds in sterilized Petric dished 4 inches in diameter, placed in a chamber surrounded by an insulated hot water jacket filled with water heated to about 80° F. This test is to be continued one month.

It is planned during the coming season to determine the ratio between the percent of seed which will germinate under ideal greenhouse conditions and the per cent of the same seed which will germinate under the more rigorous conditions found in the nursery beds. This experiment will be carried on in cooperation with the Boulder and Savanac Nurseries. A later experiment will be undertaken to determine the further ratio between these two percentages and the germination per cent on prepared and unprepared sowing sites in the field.

6. Natural Reproduction.

Numerous observations on conditions surrounding the natural reproduction of Larch, White Pine and other species in this region will be made from time to time when opportunity offers. The determination of the best methods of cutting White Pine so as to secure a new stand is one of the most pressing practical problems to be investigated, and an effort will be made to assemble

a body of data along this line from which conclusions may be drawn.

7. Thinnings.

It is planned to start experiments on the effect of artificial thinnings in young stands of Larch and White Pine.

8. Tree Studies.

Whenever possible, information will be gathered concerning Western Larch by means of volume and growth studies, phenological observations, etc., with the ultimate idea of publishing the results, as very little intensive study has been made of this species.

9. Herbarium.

A collection of native plants and trees will be started and a study made of the habitat requirements of each.

10. Sowing and Planting.

Experiments will be started to show the comparative merits of various methods of doing this work, based on time, skill and labor required and results produced. The subject will be treated more intensively than in the first Experiments. An effort will be made to eliminate unprofitable methods and standardize the details of the work so that exact and reliable information can be furnished for the conduct of large operations.

The Forests of Northern Idaho constitute such a virgin and varigated field for investigative work that

numerous experiments along all different lines readily suggest themselves. In planning the work one must constantly guard against the temptation to carry on too many things at the same time. The amount of such work that one man can do well is limited and if too much work is attempted the tendency is to resort to inexact, unscientific methods which greatly discount the value and reliability of the results. For this reason some of the work planned for the coming year may have to be postponed. On the other hand, it may be possible to add new Experiments to those already planned and still maintain a high standard of work.

Date: January 31, 1912.

Respectfully Submitted,

/s/ Donald R. Brewster,

Forest Assistant.
In Charge Priest River Experiment Station.

Org. 18, 1912.

PLATE XIV
(02270A or D1-11)

Experimental area in western larch type on Benton Flat, looking south. In south end experimental nursery and control meteorological station were established. Balance of area to be cleared and used for experimental sample plots for western larch, Douglas fir, western yellow pine and other species which take an intermediate or dry situation. Priest River valley in background.

PLATE XIV -A-
95719

Same view of experimental area in western larch type (Benton Flat) as shown in Plate XIV; taken from southwest slope meteorological station and showing Benton Flat after brush had been cleared from sample plots which were to be planted in fall of 1911, and after the meteorological instruments had been set up.

PLATE XV
(D1-13(

Control meteorological station on Benton Flat, Priest River Experiment Station. In background an aven-aged stand of 50 year old western larch. Situation representative of the larch type of northwestern Montana and Idaho.

PLATE XVI
(D1-10)

Meteorological station on southwest slope, Priest River Experiment Station. Notice presence of yellow pine seedlings in the foreground and tall spires of fire-killed larch and the dense stand of young larch on the bench beyond; on northerly slope in the background well stocked stand of white pine, Douglas fir and larch. These three sites represent the three most important types of the region, the dry yellow pine and Douglas fir type of the southwest slopes, the intermediate larch type of the more or less dry bench land, and the white pine type of the moist northerly slopes.

PLATE XVII
(D1-9)

Meteorological station on northeast slope representative of western white pine type. Slope covered with very dense growth of even aged Douglas fir, western white pine and western larch with understory of western red cedar and western hemlock.k One acre clearing made for the station site.

9517

PLATE XVIII
(D1-14)

Experimental planting areas in western larch type (Foreground) and western yellow pine type (hill in background) In immediate foreground experimental plot of western yellow pine transplants in study of climatic varieties.

PLATE XIX
(D1-15)

Site of partially prepared experimental nursery and transplant beds on Benton Flat; control metoeorlogical station and experimental area beyond.

PLATE XIX A
(D1-16)

Same as shown in Plate XIX from a different angle.

PLATE XX
(D1-26)

Site for experimental planting of exotic hard woods in western white pine type. In background mature stand of Pinus monticola, Larix occidentalis, Thuja plicata, Populus trichocarpa.

PLATE XXI

The control meteorological station on Benton Flat, in winter.

PLATE XXII

Northeast slope meteorological station in winter.

PLATE XXIII

Completed laboratory, office building and green house at Priest River Experiment Station.

PLATE XXIV

Green house, Priest River Experiment Station.

PLATE XXV

General view of Priest River Experiment Station, looking northwest, from vicinity of northeast slope weather station. In foreground Experiment Station buildings; opening in background on the left is Benton Flat experimental area; bare hill on the right is the southwest slope experimental area.

EXPERIMENT PRIEST RIVER V-1

Test of Climatic Varieties of Western Yellow Pine

Purpose:

The purpose of this Experiment is to determine the extent to which transplants raised from seed collected in distinctly different sections of the natural range of Western Yellow Pine will retain their peculiar climatic characteristics when transplanted to Northern Idaho. It is known that a species of such wide latitudinal distribution as Yellow Pine develops certain minor changes in rate of growth, hardiness, size, etc., -- the result of adapting itself to the local climate in which it grows. The varieties of the species resulting from these definite adaptations are called by German foresters, "Klimatische Varietäten" or Climatic Varieties and that name has been used to denote this series of Experiments. It is desired to know how permanent these adaptations are when the tree is grown in a different climate from that in which the seed was produced, and which of the different varieties will produce the best timber in the shortest time, in the new climate. With this information, it will be possible to obtain the maximum results from artificial reforestation work by using seed of that climatic variety which has been found to produce the best results.

The experiment will of necessity continue until the trees have reached a mature age or until such a time as one

variety has shown an unquestionable superiority over the others. Plants from as many distinct climates as it is possible to obtain will be used and they will be planted on the same site and under as nearly similar conditions as possible. For the fall work in 1911, it was possible to obtain plants raised from seed from the following eight different localities:

1. The Southern Rockies, Arizona.
2. Northeastern Rockies, Central Montana.
3. Northwestern Rockies, Northern Idaho.
4. Black Hills, South Dakota;
5. Central Rockies, Colorado.
6. Eastern Cascades, Northern Oregon.
7. Snake River, Basin, Southwestern Idaho.
8. Northern Sierras, Northern California.

An effort will be made to obtain plants from the following regions: The Great Basin, Utah or Nevada, the

2. Southern Sierras, Southern or Central California.
3. Southeastern Rockies, New Mexico.
4. Northern Cascades, Washington.

Space for these additional lots can easily be cleared adjacent to the others.

Location:

This Experiment is located on Plots 1-6, 13, 14 Block A. The soil is a sandy silt favorable for the growth of Yellow Pine. The ground has been cleared of all cover except scattered bunches of grass or weeds. It is practically level with a good exposure to the sun and has an elevation of 2360 feet.

Operations:

The eight plots were all planted in the fall of 1911 using the mound method. Great care was used in the planting since this Experiment is not a test of method but is an effort to obtain as fully stocked stand as possible without regard to cost. In all cases 1-1 transplants were used, and on plots land 2, two trees were planted in each hole as there was abundance of stock and it was thought that this would secure a fuller stocking. The planting was done in cool cloudy weather when the danger of evaporation from the roots and wilting from the sun was reduced to a minimum. Much of the stock was not received until late October or early November, coming from warmer climates where the wood does not ripen and the winter bud develop until late in October. The last planting was done November 18. Some of the later shipments were frozen in transit.

The details surrounding the planting of each plot will be discussed in the next report after the results of the first growing season are noted. An outline of the work follows:

1. Plot 1, A, Payette Seed, Wasatch Nursery, Wasatch.
2. Plot 2, A, Coconino seed, Ft. Bayard Nursery, Gila.
3. Plot 3, A, Coeur d'Alene seed, Savanac Nursery, Lolo.
4. Plot 4, A, Sioux seed, Savanac Nursery, Lolo.
5. Plot 5, A, Helena seed, Savanac Nursery, Lolo.
6. Plot 6, San Isabel seed, Boulder Nursery, Helena.
7. Plot 13,A, Shasta seed, Pilgrim Creek Nursery, Shasta.
8. Plot 14,A. Wenaha seed, Page Creek Nursery, Siskiyou.

Plots 1 and 2 were planted late in September with stock that had been taken up before it had thoroughly ripened

and the winter bud formed. A large proportion of these had wilted by October and indications were that few would survive the winter. Fail places will be filled in next spring from additional stock which was received this fall and heeled in in the nursery.

V-1 4-1912.

EXPERIMENT PRIEST RIVER V-2

Test of Climatic Varieties of Douglas Fir.

Purpose:

The object of this Experiment is exactly the same as that of Experiment V-1, except that a different species, Douglas Fir, is used. It is desired to determine the behavior of Douglas Fir transplants raised from seed collected in as many distinct climatic regions within its natural range as it is possible to obtain. The Experiment will continue until one of these so-called climatic varieties of the species has shown a distinct superiority over the others in growth and cost of production for reforestation purposes.

During the fall of 1911, plants from seed produced in the following different regions: were obtained and planted.

1. Snake River Basin, Southwestern Idaho, Boise N. F.
2. The Central Rockies, Eastern Slope, Colorado, Pike N. F.
3. The Central Cascases, Washington, Columbia N.F.
4. The Central Rockies, Western Slope, Colorado, San Isabel N.F.
5. The Northern Rockies, Eastern Slope, Montana, Helena N.F.

It is planned to obtain additional transplants from seed of the following regions:

6. The Southern Cascades, Oregon.
7. The Sierras, Northern California
8. The Great Salt Lake Basin, Nevada or Utah.
9. The Southern Rockies, Arizona or New Mexico.
10. The Northern Rockies, Western Slope, Northwestern Montana.
11. The Puget Sound Region, Washington.

These additional kinds can be planted in vacant plots contiguous to those already established. It is thought, since the Experiment is to run over a long period of years that one year's difference in starting the latter plots will be make no essential difference in the results, if the work is done in a similar manner.

Location:

This Experiment is being conducted in Block A, Benton Flat, in the same series of plots as Exp. V-1 and adjacent to it. The five plots planted in the fall of 1911 are numbers 7 to 11. The soil is sandy and favorable to Douglas Fir as indicated by thrifty young trees found nearby. The ground cover has been cleared off except scattering clumps of loose grass and weeds. The area is practically level and at an elevation of 2360 feet.

Operations:-

Since no observations have yet been made on the condition of the plots, it is thought best to reserve a detailed report on the wokk until next report when the first season's work will be completed and some comparisions can be made.

All planting was done with the greatest care since it was desired to secure as fully stocked a stand as possible without regard to cost of the operation. The mound method was used and 100 plants, five feet apart, planted in each 50 feet square plot.

EXPERIMENT PRIEST RIVER P-1

SEASONS AND METHODS FOR YELLOW PINE PLANTING AND SOWING ON FAVORABLE SITES.

Purpose:

Experiment P-1 is designed to find out the most satisfactory method and the best season of the year for reproducing Yellow Pine on the more favorable sites for this species--- the comparatively low and moist flats where it is found in mixture with Larch, Spruce and White Pine.

The four methods, broadcasting, seedspot sowing, corn-planter sowing and planting of 1-1 transplants are to be tried out both in the fall and the spring to determine the cheapest and best method and time from the standpoint of the number of thrifty plants alive after one growing season and the relative cost of labor and materail for the results secured.

Location:

This Experiment is located in Block A, on Benton Flat near the Station buildings, on plots 15 to 21. The soil is a sandy silt with sand subsoil and a layer of clay ten feet below the surface. It is a natural Larch site and is somewhat more moist than is required by Yellow Pine. The young trees of this species found growing are very thrifty.

The plots used are 50 feet square and have been cleared and grubbed of all brush and trees, leaving only an occasional tuft of loose grass or weeds. The odd numbered plots have been used for the fall work in October and December, 1911, the adjacent

even-numbered plots in the next tier being reserved for spring work with the same tests.

Operations:

Since just half of the Experiment has been started it is thought best to reserve a detailed statement of all operations and facts bearing on the work until results are secured and comparisons can be made. A brief outline of the work started and planned is given:

A. Fall work, 1911.

1. Plot 15, Block A on harrowed ground

Sown broadcast December 6 at the rate of 2 seeds per square foot on basis o f cutting test, seed, Bitterroot, 1911. This seed runs 10,500 per pound with cutting test of 77%.

2. Plot 17, Block A.

Sown in seedspots, December 5, 100 spots per plot, at rate of 15 good seeds per spot, basis cutting test; seed, Bitterroot, 1911.

3. Plot 19, Block A.

Sown with cornplanter, December 6, 190 spots per plot, at rate of 15 good seeds per spot, basis cutting test; Bitterroot, seed, collected 1911.

4. Plot 21, Block A,

Planted with 1-1 transplants, raised at Savanac Nursery from Coeur d'Alene seed, 100 trees, 5 feet apart.

B. Spring work, 1912, planned.

1. Plot 16, Block A.

To be broadcasted @ 2 seeds per square foot, with seed collected on Bitterroot in 1911, on harrowed ground.

2. Plot 18, Block A.

To be sown in seedspots, 15 good seed per spot with seed collected on Bitterroot in 1911.

3. Plot 20, Block A.

To be sown with cornplanter, 15 good seed per spot, with seed collected on Bitterroot, 1911.

4. Plot 22, Block A.

To be planted with 1-1 transplants, raised at Savanac Nursery from Coeur d'Alene seed.

EXPERIMENT PRIEST RIVER P-2

Seasons and Methods of Yellow Pine Sowing and Planting.

On Poor Sites.

Purpose:

This Experiment is similar to Experiment P-1 except in location, the prupose being to discover the cheapest and best method and season for artificial reforestation with Yellow Pine on the numerous hot, dry, rocky, south and west slopes of this region. This species is found growing on such sites and it reaches large size and good commercial form but its natural reproduction, particularly after burns, is very slow and uncertain. Those methods which have proved most promising by previous experience are to be tried out and conclusions will be based on the number of good plants alive after a certain period and the comparative cost of labor and materials.

Location:

Plots 7 to 12 in Block B on the south west hillside have been chosen for this work, as being quite typical of the dry Yellow pine-Douglas Fir type. The elevation is 2500 feet, the soil shallow and sandy with considerable gravel and talus and occasional outcroping rock.

The ground cover of freguent clumps of willow and other shrubs and scattering grass was left undisturbed as it is an accompanyment of similar work on all such sites.

The barest plot waschosen for the broadcasting work.

Operations:

Since half of the work planned still remains to be started a brief list of the plots already planted and sown and those planned is given, the full data on each operation being reserved until results are secured and comparisons can be made.

A. Fall work-1911.

1. Plot 7, Block B.

Planted November 21 with 1-1 transplants raised at Savanac Nursery from Coeur d'Alene seed, Slit method used with mattock, 100 plants per plot, 5 feet apart.

2. Plot 9, Block B.

Sown December 6 with cornplanter, 100 spots per plot, 5 feet apart, at rate of 15 good seeds per spot, basis cutting test. Seed collected on Bitterroot, 1911. It runs 10,500 per pound with a cutting test of 77%.

3. Plot 11, Block B.

Sown December 6 broadcast at the rate of 2 good seeds per square foot, basis of cutting test, seed Bitterroot, 1911.

B. Spring work-1912, planned.

1. Plot 8, Block B.

To be planted with transplants, Coeur d'Alene seed.

2. Plot 10, Block B.

To be sown with cornplanter, Bitterroot, 1911 seed.

3. Plot 12, Block B,

To be sown broadcast, Bitterroot, 1911 seed.

EXPERIMENT PRIEST RIVER P-3.

SEASONS AND METHODS FOR DOUGLAS FIR PLANTING AND SOWING ON FAVORABLE SITES.

Purpose:

This Experiment has a similar object to that of Exp. P-1, except that Douglas Fir instead of Yellow Pine is involved. Since Douglas Fir is one of the most important timber trees of the dryer habitats of District 1, it is desired to have more definite information as to the best and cheapest method and the right season of the year for planting or sowing it on the large areas in need of reforestation. Three methods will be used, broadcasting on unprepared but otherwise favorable ground, sowing with cornplanter, and planting 2-1 transplants, each method to be tried in the fall and in the spring.

Location:

Plots 23 to 28 in Block A, Benton Flat have been reserved for this Experiment, the three odd numbered plots for the fall work and the even-numbered ones for the spring tests. The soil is sandy and warm and is shown to be suited to Douglas Fir by the vigorous young trees, found near by. It is a natural larch habitat with some White Pine in mixture and is what might be termed a favorable site for Douglas Fir. The elevation is 2760 feet and the ground is almost level. The ground cover has been cleared except for scattered clumps of loose grass and herbs.

Operations:

Since no results have yet been secured and all of the tests have not yet been started, it is thought best to reserve detailed data concerning each test until next report after the first field season when the information will be much more complete and comparisons can be made. A brief outline of work started and planned as follows:

A. Fall work, 1911.

1. Plot 23, A, 2-1 transplants, Helena seed, mound method. 100 trees, per plot, five feet apart.

2. Plot 25, A, Sown with cornplanter, 20 good seeds per spot, basis of cutting test, Madison seed, collected 1910.

3. Plot 27, A, Sown Broadcast, at the rate of 5 good seeds per square foot, basis of cutting test, Madison seed, 1910.

B. Spring work Planned.

4. Plot 24, A, 2-1 transplants, Helena seed

5. Plot 26, A, To be sown with Cornplanter, Madison seed, 1910

6. Plot 28, A, To be sown broadcast, Madison seed, 1910.

The soil to be broadcasted, although not especially prepared is in favorable condition, having been roughened and broken up by the clearing and grubbing and having a large percent of mineral soil exposed.

If space permits an additional plot will be sown in the spring in seed spots, 20 good seed per spot, to test this method.

EXPERIMENT PRIEST RIVER P-4.

Season and Methods for Douglas Fir Planting and Sowing on Poor Sites.

Purpose:

The purpose of this Experiment is similar to that of Exp. P-2, except that Douglas Fir is used instead of Yellow Pine. The most satisfactory method and the best time of year for reproducing Douglas Fir on the poorer sites of its natural habitat are the points which it is sought to establish. Douglas Fir is equally important with Yellow Pine as a timber tree for the dry, south slopes of this region and this information will be of considerable practical value in any extensive reforestation projects that may be undertaken in the future.

The basis of comparison will be the number of thrifty plants growing after the first and second seasons and the comparative cost of labor and material, per resulting tree.

Location:

Block B has been selected as typical of the hot, dry, slopes on which Douglas Fir is found growing. The species is shown to be suitable to the site by the occasional trees and seedlings found but natural reproduction on such ground is scattering and uncertain and there is extensive need for artificial help before complete restocking can take place. The soil is shallow, composed of sand and gravel with outcropping rock. The cover is brush, shrubs, and herbs, with scattering tufts of grass. This cover has been left undisturbed

as being a typical problem encountered on all such sites.

The plots are 50 feet square and are on the southwest face of the ridge, at an elevation of 2500 feet, plots 1 to 6.

Operations:-

Detailed data concerning each test will be delayed until the results of the first season's work are obtained when information will be more complete and definite conclusions can be drawn. A brief outline of the tests is as follows:

A. Fall work, 1911.

1. Plot 1, B, Sown boradcast at the rate of 5 good seeds per square foot, on the basis of the cutting test, Madison seed, 1910

2. Plot 3, B, Sown with Cornplanter at the rate of 20 good seed per spot on basis of cutting test, Madison seed, 1910.

3. Plot 5, B, Planted with 2-1 transplants, Helena seed, 100 plants, five feet apart, slit method with mattock used.

B. Spring work planned, 1912.

4. Plot 2, B, To be sown boradcast at 5 good seed per square foot.

5. Plot 4, B, to be sown with cornplanter at 20 good seed per spot.

6. Plot 6, B, To be planted with 2-1 transplants, Helena seed.

The plot to be broadcasted was selected as being the most bare and open and having the most mineral soil exposed.

EXPERIMENT PRIEST RIVER P-5

Seasons and Methods for Western White Pine Planting and Sowing on Favorable Sites.

Purpose:

This Experiment is designed to demonstrate which method and which time of year produces best results in the regeneration of White Pine on Favorable Sites. The problem of securing a small new stand of White Pine on sites adapted to it in this region is probably one of the most pressing silvicultural problems since the species is the most important timber tree of the section and will probably continue to be. Efforts to secure natural reproduction by various systems of cutting have not been entirely successful and it is not improbable as the timber increases in value, that clear cutting with artificial reproduction will be extensively used in the future.

A comparison of broadcasting, seedspot and cornplanter sowing and planting of 2-1 transplants is to be made on the basis of the number of thrifty trees living after a reasonable time and the cost of labor and materials. Comparisons will also be made with the results of natural reproduction secured on adjacent ground by the system of clear cutting and burning of slash with surrounding seed plots left. Observations along this line will be made in another Experiment, see Natural Reproduction, Exp. R-1.

P-5, 1-1912.

Location:

This Experiment is located in Block C, the burned over cutting in the Station area. Half of the plots are placed

close to a seed plot on the north side of the area and the other half are located in the center of the cutting as far as possible from the seed plots. The first half is on land burned over once on which the soil is still quite full of humus and vegetablre matter, while the second series is on land severly burned twice, the vegetable content having been largely removed by the intense heat. It is thought that the large number of burned logs scattered over Block C will absorb considerable heat and increase the temperature of the top soil and of the lower layers of air. An attempt will be made to determine the extent and effect of this influence. Plots have been cleared of logs.

The soil is a rich reddish-black clay loam and supports trees and vegetation in abundance. It is moist and not very well drained, slightly rolling and from 20 to 100 feet above Priest River at an average elevation of 2300 feet. White Pine thrives exceptionally well here but is subject to severe competition from the shade bearing species, Cedar, White Fir and Hemlock, the ultimate natural type.

Operations:

Detailed data will be included in the next report, after the first field season, when comparisons of results can be made. The work started and planned is briefly as follows:

1. Plot 5, C. Planted with 2-1 transplants, Coeur d'Alene seed.

2. Plot 7, C, Sown with cornplanter, 25 good seeds per spot, basis of cutting test, 1½ ounces per plot, Lolo seed, 1911.

3. Plot 9, C, Sown broadcast on unprepared ground, at rate of 5 good seed per square foot, basis of cutting test, Lolo seed, 1911

4. Plot 17, C, Planted with 2-1 transplants Coeur d'Alene seed.

5. Plot 19, C, Sown in seedspots with mattock, at rate of 25 good seeds per spot, basis of cutting test, Lolo seed, 1911.

6. Plot 21, C, Sown broadcast at the rate of 5 good seeds per square foot, basis of cutting test, Lolo seed, 1911.

B. Spring Work Planned, 1912.

Exact duplication of items from 1 to 6 on Plots, 6, 8, 10, 18, 20, 22, respectively.

EXPERIMENT PRIEST RIVER E-1

## Introduction of Sugar Pine and Norway Spruce on two sites.

Purpose:

The object is to show the behavior of these two species, Norway Spruce and Sugar Pine, under the conditions of soil and climate at the Experiment Station. Both might prove valuable trees if they could be made to grow in this region.

Location:

Each species was tried on two distinctly different sites, Block A, a medium dry sandy bench, most favorable to Larch and Block C, moist, rich low land most favorable to White Pine and Cedar. Both blocks are on the Station area.

Operations:

Norway Spruce, 2-0 seedlings, raised at the Wind River Nursery on the Columbia Forest in Washington, were planted on Plots 29, Block A, and 15, Block C. The source of the seed is not known but this will be ascertained.

Sugar Pine transplants, 1-1, raised at the Pilgrim Creek Nursery on the Shasta Forest in Northern California, from Shasta seed, were planted on plots 30, Block A, and 13 Block C, adjoining those used for the Norway Spruce.

The stock used had been frozen in transit and the planting was done with six inches of wet snow on the ground. The soil beneath was soft and moist and in excellent condition for the work, however.

EXPERIMENT PRIEST RIVER E-2.

## Introduction of Hardwoods on Favorable Sites.

Purpose:

The purpose is to find out the various Eastern Hardwoods which will grow and mature in this climate and produce trees of value. The tree growth of Northern Idaho is so distinctly coniferous that it is hoped to be able to find some valuable hardwoods which will also thrive here.

Location:

The work of this Experiment will be carried on at various points in the Station area, Blocks A and C, and in the vicinity of the buildings. It is planned to start an arboretum of a few specimens of as many different trees as will grow here on some apparently favorable ground near the buildings where sites of various moisture contents and soils can be found within a short radius.

Operations:

As yet only a start has been made on this Experiment.

Three tests have been started, as follows:

1. Plot 1, Block C, Planted with 1-0 basswood seedlings from Dundee, Ill, November 20, with about six inches of wet snow on the ground but with the soil otherwise moist and favorable.

2. Plot 3, Block C, Planted with 2-0 seedlings of White Ash from Dundee, Ill, November 20, with same conditions as 1.

3. Plot 11, Block C, Planted with shagbark hickory nuts from Wedge Nursery Co, Southern Minnesota, December 1.

This Experiment will be continued more extensively in the spring when we are expecting to receive a number of 14 different Eastern Hardwoods from the Michigan Agricultural College, the Wedge Nursery Co. and other sources. A complete list of these is not definitely known as yet but is is planned to include if possible all of the important timber trees which grow in the northern states.

EXPERIMENT PRIEST RIVER S-1

Seed Production of Western White Pine in 1911.

Purpose:

This Experiment has been carried out in accordance with the plan outlined by the Washington Office in August. The object is briefly to determine for the species observed; the percentage of the trees of a stand which are bearing seed; the amount and fertility of cones and seed borne by each tree; the class in which each tree belongs, as dominant, sub-dominant, suppressed; the difference in the seed bearing ability of trees of different ages; the effect of the composition of the stand on the amount of good seed produce; and other minor points.

Location:

During early September sample plots in various parts of the White Pine Type were taken, three in the Priest River valley near the station and one on the Coeur d'Alene Forest. All of these plots were in different aged stands and characterized by different site conditions.

Operations:

All trees of every species found on the plot were first listed by diameter classes and at the same time the White Pines were divided into the five Classes: Dominant, Sub-dominant, Intermediate, Oppressed and Suppressed and these further sub-divided into a, b, and c, if thought necessary. A notation was made as to whether they bore any cones, after determining this with a glass. Then ten per cent and at least one tree of each cone bearing class was felled, the rings counted,

and the cones collected and placed in a separate sack. Later the cones were carefully weighed and measured and the number of open or partially open cones noted to take account of any seed that had previously fallen from the cones while the tree was standing. The cones ripened very rapidly owing to some hot weather in early September and it was not always possible to find trees with cones till unopened.

This winter, the various lots of cones have been extracted carefully by hand, since there has been no opportunity as yet to provide extracting apparatus. The cones were first partially opened by hanging the sacks in a warm room before extraction. It is thought that the germination tests to be finished in February will show as true a vitality test as is possible, since this method of extraction can do the least possible damage to the seed and very closely simulates sun-drying. Tests of vitality will be made in Petrie dishes in the green house and when the results are available a fuller and more detailed report with tables and all data will be assembled, and conclusions drawn.

EXPERIMENT PRIEST RIVER M -1

Continuous Daily Meteorological Observations

at three Permanent Weather Stations.

Purpose:

This Experiment is to determine the general climatic characteristics of the region and the ecological differences in the sites of the three main Forest Types found here,-- the dyy Yellow Pine-Douglas Fir Type, the intermediate Larch Type and the Moist White Pine-Cedar Type. Detailed data of this sort is essential in the scientific study of vegetation and in interpreting and understanding the success or failure of Experiments undertaken.

Location:

Three meteorological stations have been established within a radius of one quarter mile of the Station buildings and connected by a system of trails. Station 1 is on a steep Northeast slope in the White Pine type. A clearing of an acre has been made here to get rid of the immediate influence of the Forest. The elevation is 2500 feet. Station 11 is located at the same elevation across the Creek valley on a bare southwest slope in the Yellow Pine Type. Station III is on a sandy bench in the Valley at an elevation of 2360 feet, in the intermediate Larch type. The latter is designated as the control station since it is in most ways an average between the other two, and will furnish the best data on general climate.

Operations:

Each station is equipped with maximum and minimum therm-

ometers and thermographs for the study of air temperatures; sling psychrometers for the study of relative humidity; anemometers for the study of wind velocity, standard rain guages for the study of precipitation; and a wind vane for the study of local wind direction. The control station, No. III, has in addition, a tipping bucket rain-gage for the automatic registering of precipitation; a shielded rain and snow gage, for catching and determining the water content of snow, sleet, and winter rain, by weighing; and a whirling psychrometer in a large shelter for determining the air humidity with the greatest accuracy, as a check on the sling instruments. This Station is connected with the laboratory by a 1500 feet line of insulated copper wire. Here a double register gives a continuous record of wind velocity and sunshine, and a precipitation, record in all but freezing weather. A sunshine recorder has recently been furnished by the Weather Bureau and will be installed in February. The tipping bucket gage cannot be used during the winter.

The vanes at the stations do not usually give the true prevailing direction for the region because of local currents. In order to get this true direction, a vane will have to be erected at the crest of the ridge south of the station (2900 feet elevation), and observed from time to time through glasses. This will require considerable trail building and an extra large wind vane would be needed. Observations are being made of the prevailing direction of the clouds, whenever their movement are visible. This will furnish information of valve as to the true wind direction, and will be a check on the directions at the three stations.

Starting as early as possible in the spring, daily readings of soil temperatures and soil moisture will be made at depths of one foot and two feet at each station.

Daily observations are taken at each Station starting at station 1 at 5 P.M., then reading Station 11 on the opposite hill at 5:30 P.M. and lastly the control station No. 111 at 6:00 P.M. The time used is that of the 105th Meridian, known as Mountain Time. The station is located on the 116th Meridian and the more logical time to use would be that of the 120th Meridian or Pacific time. It is found more convenient to take the readings at the close of the day, however, so as to not interrupt other work. Even with Mountain time the readings have to be made with a lantern during the winter and it would be very undesirable to make them an hour later on account of the poorer light. A further reason for making the observations at this time is that it corresponds to 7 P.M. and 8 P.M. of 75th Meridian time, the standard Weather Bureau time, and Weather Bureau readings are taken at this hour (8 P.M.) all over the country. Furthermore since it is possible to take only one reading per day, that reading is best taken in the evening as the maximum and minimum temperatures read, almost always occur in the early morning and at noon of the same day on which the reading is taken.

This Experiment requires one-quarter or more of one man's time in taking readings and keeping tabulations and records up to date. At the end of each month, a duplicate record of all data is forwarded to the Section Director of the Weather Bureau at Helena Montana. The reading was started December 1, 1911.

EXPERIMENT PRIEST RIVER N-1

Amounts of Yellow Pine Seed to be sown in Nursery Beds.

Purpose:

This Experiment is designed to find out the smallest amount of Yellow Pine seed which when sown broadcast will produce a fully stocked stand of seedlings.

Location:

Bed No. 2 in the Station Nursery is devoted to this Experiment. This bed is 4' x 8', enclosed by a frame and netting. The soil is sandy silt with sand subsoil.

Operations:

Sowing of this bed was delayed because the seed needed was not sent until December 4, at which time the ground was frozen and covered with a foot of snow. Hoping that a thaw would come the work was delayed until December 22 when fires were built and the surface thawed out so that it could be smoothed off. Unfrozen sandy soil was then sifted on to make a good seed bed and the seed sown broadcast and covered by sifting sand ½" deep evenly over the surface, with round sand sieves. It is thought that this procedure although somewhat unusual will not affect the result unfavorably. Bitterroot seed, collected in 1911, was used.

One third of the bed was sown at the rate of 2 pounds per bed, or about 2½ good seeds per square inch on a basis of the cutting test. The seed ran 10500 per pound, cutting test 77%.

One third bed was sown at 2½ pounds per bed, or 3 good seeds per square inch.

One third bed was sown at 3 pounds per bed or 3½ good seed per square inch.

The unusually large heavy seed used made it necessary to increase the rate per bed above the amounts first planned--1, 1½ and 2 pounds per bed. This matter of the number of seed per pound is very important as Black Hills and Boise seed has almost twice as many seed per pound as the Bitterroot seed.

If space permits, this Experiment will be increased in scope during the coming season by trying out other quantities and lots of Yellow Pine seed.

EXPERIMENT PRIEST RIVER N-2.

Amounts of Western White Pine Seed to be Sown Per Bed.

Purpose:

Similar to Exp. N-1, using White Pine instead of Yellow Pine. The object is to determine the smallest amount of White Pine seed which, when sown broadcast in a 4x12 nursery bed will produce a full stand of seedlings under normal conditions.

Location:

Bed No. 1 is used for this work, located in the Station Nursery on Benton Flat. Sandy silt soil with sand subsoil.

Operations:

Seed collected on the Lolo Forest in 1911 was used. The work was done November 23, the ground being soft and in excellent condition from the melting of an early snow. The seed bed was first prepared by sifting the sandy soil on the smooth top of the bed and after sowing the seed, it was covered with sifted sand ½ inche deep taken from the subsoil. The seed ran 28,000 per pound, cutting test 95, making 26,800 good seed per pound.

One third bed was sown at ½ pound per bed, or 3 good seeds per square inch.

One third bed was sown at 1 pound per bed, or 4 good seeds per square inch.

One third bed was sown at 1½ pounds per bed, or 6 good

seeds per square inch.

If space permits another bed will be sown in the spring with different amounts of the same lot of seed as a continuation of this Experiment.

EXPERIMENT PRIEST RIVER N-3

Seasons and Methods for Sowing Yellow Pine in Nursery Beds.

Purpose:

This Experiment is to determine whether broadcasting or drill-sowing and sowing in the spring or fall is the most satisfactory for producing a stand of Yellow Pine seedlings in Nursery Beds.

Location:

Bed No. 4, in the Station Nursery.

Soil sandy silt with sandy subsoil, bed enclosed in permanent frame and ½ inch netting, 4' x 12'.

Operations:

Seed collected on the Bitterroot in 1911 was used.

Work was delayed until December 22 by the later arrival of the seed and the frozen condition of the ground. The surface was thawed out by fires, leveled, and seed bed made by sifting dry sand on. Seed was covered ½ inch deep with sifted sand.

One sixth bed was sown in drills at ⅔ pound per bed or 17 good seed per inch of drill, drills 6 inches apart.

One sixth bed was sown broadcast at 2 pounds per bed or 2½ seeds per square inch.

One third bed will be sown in a similar manner with untreated seed in the spring and one third bed with seed soaked in water for twenty four hours just before sowing. It is thought that this may overcome the tendency of some of the seed to lie over one season when planted in the spring. The large size of the seed makes it impossible to sow a very large number in drills.

N-3, 10.1912.

EXPERIMENT PRIEST RIVER N-4.

Seasons and Methods for Sowing White Pine in Nursery Beds.

Purpose:

This Experiment is intended to show the relative merits of fall sowing and drill or broadcast sowing in producing a good stand of White Pine seedlings in the Nursery.

Location:

Bed No. 3 in the Station Nursery is assigned to this Experiment. It is 4x12, enclosed by a frame and wire netting with a sandy silt soil underlaid by sand subsoil.

Operations:

Seed collected on the Lolo Forest in 1911 was used.

This seed runs 28,000 per pound, cutting test 95% giving 26,800 good seeds per pound. The work was done November 23, 1911. The soil was in good condition from the melting of an early snow. The bed was leveled, smoothed with sifted soil and the seed covered with ½ inch of sifted sand.

One sixth bed was sown in drills, 6 inches apart, at the rate of ½ pound per bed or 11 good seed s per lineal inch.

One sixth bed was sown broadcast at 1½ pounds per bed or 6 good seed per square inch.

One third bed will be sown in a similar manner with untreated seed next spring and one third with seed soaked in water 24 hours just before sowing. It is hoped that soaking the seed may overcome the tendency of some of the seed to lie over one season.

EXPERIMENTS PRIEST RIVER N-5.

## Depth of Covering for Yellow Pine in Nursery Beds.

Purpose:

To show the most satisfactory depth of covering for seed of Yellow Pine in nursery beds.

Location:

Bed No. 6 in the Station Nursery is devoted to this Experiment. It is 4 x 12 enclosed by a frame and netting and conteins a sandy silt soil, with sand subsoil.

Operations:

Seed used was collected on the Bitterroot in 1911 and ran 10,500 seed per pound, with a cutting test of 77%. Sowing was done in drills 6 inches apart at the rate of 7 good seed per lineal inch or 12 ounces per bed.

One sixth bed was sown and covered to each of the following depths:

1/8 inch
1/4 inch
1/2 inch
3/4 inch
1 inch
1-½ inch

Work was delayed until December 22 by the late arrival of the seed and the frozen condition of the ground. The surface of the bed was heated with wood fires and leveled with sifted soil. The seed was covered with sifted sand to the desired depth, which was indicated by marked stick placed at various points.

EXPERIMENT PRIEST RIVER E-6.

## Depth of Covering for Western White Pine in Nursery Beds.

Purpose:

This Experiment is designed to show how deep the seed of White Pine should be covered in the nursery to secure the best results in a stand of seedlings.

Location:

Bed No. 5 in the Station nursery is used for this Experiment. It is 4 x 12, enclosed by frame and screen and has sandy silt soil with sand subsoil.

Operations.

Seed used was collected on the Lolo Forest in 1911. It contained 28,000 seed per pound and showed a cutting test of 95%, making 26,600 good seed per pound. The work was done November 23 when the soil was in good condition from the melting of an early snow. The bed was leveled and smoothed with sifted sand and the seed was covered with sifted sand. Sowing was done in drills 6 inches apart at the rate of ½ pound per bed or 11 good seeds per lineal inch of drill. The desired depth was indicated by marked sticks placed at intervals.

The following tests were made each in four drills or 1/6th bed: Seed covered, 1/8 inch, 1/4 inch, 1/2 inch, 3/4 inch, 1 inch, and 1-½ inch.

EXPERIMENT PRISST RIVER N-7.

## Effect of Fall Transplanting of Nursery Stock.

Purpose:

This Experiment is to show the practicability of transplanting different species and ages of Nursery stock in the fall, instead of in the spring as it has almost always been done in the past. Spring is always the busy season in the nursery and if part of the transplanting could be done in the fall it would be a great help. If the transplanting is done early enough in the fall so that the roots can have a chance to set and become physiologically active and still avoid the danger of the opening of the buds, the seedlings transplanted would perhaps gain an entire additional month of growth in the spring, the time when growth is most vigorous.

Location:

The work is to be done at the Station nursery, using various stock left over from other Experiments.

Operations:

Various amounts of six different lots of trees were set out in the transplant beds during the latter part of September and the first part of October. Observations will be made on these during the coming season and results given in the next report.

EXPERIMENT PRIEST RIVER G-1

## Germination Tests of Seed for Spring Work - 1912.

Purpose:

This Experiment is for the purpose of testing the germinating power of all seed examples concerning which information is desired for spring sowing in 1912. This includes samples sent in from Forests and nurseries of the District and seed to be used in Station work.

Location:

This work will be done in the Station green house.

Operations:

Tests will include : 1. A cutting test. 2. A soil test in sterlized sand in flats. 3. A chamber test in Petrie dishes on moist blotting paper. The soil tests will last three months, and the chamber tests one month. Weights of all samples will be taken to centigrams. Up to February 1, 28 soil tests have been started,, 18 on January 10, 9 on January 19, and 1 on January 20. Chamber tests will be started early in February as soon as the proper equipment is received. The first soil tests started to sprout January 19.

For the soil tests the greenhouse is kept at a temperature ranging between 50° and 80° F. averaging 65° F. The chamber tests will be conducted in a sterilized chamber with an insulated water jacket and will be heated by hot water at from 90° to 70° F.

Miscellaneous testing in connection with other Experiments will be made from time to time but not recorded as a separate Experiment in seed testing. G-1, 1-1912

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